The Reliability of Early Language Assessment Tools

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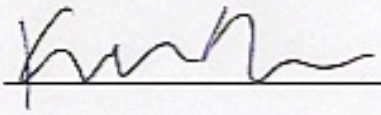
Signature 

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ABSTRACT

The purpose of this study was to investigate the reliability of early language assessments in the attempts to quantify the stability and consistency of standardized and criterion-referenced scales. This study involved 12 participants, 7 males and 5 females between 7 months of age to 2 years and 10 months of age. Each child participated in a comprehensive speech and language evaluation, involving the administration of several assessment tools of speech and language abilities. Caregivers additionally participated, providing insight on their child's current abilities and behaviors. Tests included *Ages & Stages Questionnaires, Third Edition, The Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction*, *Preschool Language Scales, Fifth Edition*, and *Receptive-Expressive Emergent Language Test, Third Edition*. Results of the study revealed that the *PLS-5* composite language score was most related to the *REEL-Expressive, REEL-Total,* and *ASQ-Problem Solving.* Agreement was measured, with findings indicating inconsistency between diagnoses within each measure. Essentially, screeners should demonstrate higher sensitivity and specificity rates, which raises concern for the use of the *ASQ-3* as a primary screener within pediatric medical facilities. Overall, with the younger population of children between 0 to 3 years of age, the best representative test results may stem from the use of multiple comprehensive assessments to fully gauge a child's speech and language abilities.

TABLE OF CONTENTS

Chapter I: INTRODUCTION……..1

Early Language Childhood Assessments…..……..……1

Chapter II: REVIEW OF THE LITERATURE…..……..……...…2

Communication……2

Language……..3

Speech……..4

Language Development (Birth to 1 Year of Age)……...4

Reflexive, Pre-Linguistic Development……..5

Linguistic Development……..8

Language Development (1 to 3 Years of Age) ……...9

Phonology……9

Semantics……...……10

Syntax……11

Morphology……11

Pragmatics……..……12

Common Language Delays and Disorders……14

Delay Versus Disorder……...……14

Early Symptoms…….……16

Late Talkers……...……16

Primary Language Disorders……..…17

Secondary Language Disorders…….……17

Assessment……18

Importance of Early Identification……18

Federal Requirements……19

Assessment Types……21

Screening……22

Standardized Assessments……23

Play-Based Assessments……23

Reliability and Validity of Early Language Assessments……25

Factors Affecting Reliability……25

Importance of Reliability……26

Rationale/Purpose……28

Chapter III: METHODS……31

Participants……31

Measures……32

Ages & Stages Questionnaires, Third Edition (ASQ-3)……32

The Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction……32

Preschool Language Scales, Fifth Edition (PLS-5)……33

Receptive-Expressive Emergent Language Test, Third Edition (REEL-3)……34

Procedures……34

Analysis……37

Chapter IV: RESULTS……39

Correlations……39

Regression Analyses……41

Consistency Among Diagnoses……..……42

Chapter V: DISCUSSION……..……44

Implications……47

Limitations……..…48

Conclusions……49

REFERENCES……...……50

APPENDIX A: Institutional Review Board Approval……..……57

APPENDIX B: Institutional Review Board Parent Consent……..…60

APPENDIX C: Individual Participant Data……...……64

LIST OF TABLES

Table 1: Assessment Tools Administered……..……37

Table 2: Descriptive Statistics: Mean Standard and Scaled Scores……...……40

Table 3: Correlations Among Predictors……...……41

Table 4: Number of Participants Identified with Atypical Language Abilities……..…43

Table 5: Agreement Among Tests…….43

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Chapter I

INTRODUCTION

Early Language Childhood Assessments

Interactions are governed by the ability to communicate. Starting from birth, a child begins to communicate reflexively, adapting their communication abilities to verbal speech typically by the first year. During the transition between reflexive, pre-linguistic development to meaningful speech and word combinations, language is developing across areas of form, content, and use. Between the ages of 1 and 3, emerging language components of phonology, semantics, syntax, morphology, and pragmatics support learning and overall communication. Without a solid foundation of speech and language, communication breakdowns begin to appear, indicating a possible delay or disorder in language.

Early professional intervention and guidance can greatly benefit children at this age who are experiencing such communicative difficulties. Appropriate screening and assessment tools are utilized to identify children who can potentially benefit from such services. In assessing early language abilities, assessments can include language screeners, criterion-referenced instruments, developmental scales, standardized assessments, and play-based assessments. Within the field of speech-language pathology, the quality measure of reliability provides measurable information in regards to the stability of a certain assessment. For the purpose of this paper, four assessments were considered and measured in terms of reliability.

Chapter II

REVIEW OF THE LITERATURE

Communication

The act of communication is dependent on a speaker and receiver's ability to exchange ideas, information, thoughts, and feelings appropriately. Starting from birth, communication occurs in the form of reflexive actions, as infant responses are unplanned, without any intentions towards a particular outcome. Within this phase, infants' communication is considered pre-intentional, as cognitive development has not occurred yet in terms of representing ideas and achieving goals (Paul & Norbury, 2012).

Through caregiver interaction and modeling, infant engagement and readiness to interact are facilitated. Gradually, intentional communication is learned, i.e. infant learning that the act of crying has the potential to elicit food and comfort (National Institute on Deafness and Other Communication Disorders, 2010). At about 7 months of age, verbalizations begin to emerge as the infant moves through stages of cooing, laughter, and verbal play.

During this time, infants learn to process their verbalizations through proprioceptive and kinesthetic feedback. Babbling progresses from a canonical to variegated structure of consonants and vowels. As the infant's verbal repertoire expands to include a variety of CV and VC combinations and intonational contours, word-like utterances similar to speech, or protowords, begin to emerge (Paul & Norbury, 2012).

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association [APA], 2013) states "communication includes any verbal or nonverbal behavior (whether intentional or unintentional) that influences the behavior, ideas, or attitudes of another individual" (p. 41). From birth through 12 months of age, an infant achieves different methods of communication. Whether the pre-linguistic or reflexive stage, typical developing infants make their wants and needs apparent through nonverbal or verbal communication. As maturation occurs, communication methods advance from stages of non-words, protowords, to eventually what is known and understood as verbal speech.

Language

Language is the representation of the concepts and ideas of communication. It is an abstract system containing rules that govern basic units (sounds, morphemes, words, sentences) to create meaning and use (McCormick, Loeb, & Schiefelbusch, 2003). By demonstrating proper production and comprehension of language, it is implied that such individual can actively navigate and properly utilize the form, function, and use of a conventional language system (Hulit & Howard, 2002).

Language enables social contact, allowing individuals to communicate and function in a society through conveying messages, expressing feelings, and achieving their wants and needs (Lu, 2000). The act of communicating through language is accomplished through nonlinguistic or linguistic modes. As long as such modes follow the rule-governed conventional system of language, communication is achieved. Examples of linguistic communication include sign language, written words, pictures, gestures, eye contact, facial expressions, and bodily movements. These types of

nonlinguistic communication can either be used independently or paired with speech and language (McCormick et al., 2003).

Speech

Speech is the spoken form of language, achieved through sound manipulation of the human voice (Martin & Miller, 2012). This expressive production of sounds is based on the physiological and neuromuscular coordination of respiration, phonation, resonance, and the articulatory systems (Hulit & Howard, 2002). In order to achieve communication through speech, speech sounds must be organized in rule-based sequences and paired with meaning to affect change. As individuals gradually develop their language ability and ease in utilizing a language specific speech sound system, communication slowly increases to a more conversational level.

Language Development (Birth to 1 Year of Age)

Different theoretical approaches have been proposed in regards to language acquisition. Generally speaking, there are two theories that have been hypothesized regarding the acquisition of language. On one side, language is considered an innate process, something that every individual possesses. The opposing side of this theory holds the theoretical basis that language is only acquired through gradual scaffolding, learning either by experience or motoric movements. Linguists support the basis of a learned language, while theoreticians believe that individuals possess an innate, underlying capacity to achieve successful language acquisition (Martin & Miller, 2012).

The field of linguistics focuses on the breakdown on language within a smaller scale. Linguists regard language as an abstract use of conventional symbols, learned progressively over time through interactions with the surrounding environment (Nor &

Rashid, 2018). On the other hand, theoreticians believe "every human is biologically equipped to learn language" (Nor & Rashid, 2018, p. 163). Noam Chomsky is a prominent theorist, who proposed a Language Acquisition Device (LAD) as an innate aspect of language acquisition. He initially theorized that this inborn LAD was responsible for the initial stages of language development. Noam Chomsky's LAD proposal is an example of how theorists attribute the ease in grasping the abstract nature of language to an innate, underlying function born within an individual (Oller, Oller, & Oller, 2015).

While no specific theory has been irrefutably been proven correct, language acquisition and learning is a complex process that requires a diverse interworking of experiences and intrinsic capabilities. It is crucial to understand the process of language development as extensive growth occurs across the early years of life when considering children who exhibit characteristics of a language delay or disorder. There are many interrelated factors that affect change and success of processes that underlie language comprehension and use.

Reflexive, Pre-Linguistic Development

From birth to 6 months of age, an infant will communicate through reflexive vocalizations. Fussing, crying, coughing, and sneezing are among the infant's first reflexive vocalizations (Lu, 2000). Vowel sounds are first to emerge, with consonant sounds later added and paired with present vowel sounds around 7 to 9 months of age (Mize, 2008). The presence of consonant-vowel syllables within an infant's verbal repertoire indicates growth within pre-linguistic development as the infant progresses on to babbling. Oller, Levine, Cobo-Lewis, Eilers, and Pearson (1998) describe babbling as

"a manifestation of an emerging linguistic capacity in its form and in its use as a medium of transmission of emotional content between infants and other people" (p. 2). At this developmental stage of speech, these vocalizations are classified as pre-linguistic communication, as they hold no linguistic intent.

Between 8 and 13 months of age, communication patterns begin to mature from reflexive actions to intentional attempts to communicate. These patterns coincide with the infant's first signs of language comprehension (Syrnyk, & Meints, 2017; Thal, Marchman, & Tomblin, 2013). At around 9 months of age, children frequently demonstrate the first signs of word comprehension (Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994).

Syrnyk and Meints (2017) conducted a study examining word comprehension in nine-month-old infants, using both cross-sectional and longitudinal data. Word comprehension was measured through intermodal preferential looking (IPL), as each infant was presented a specific auditory prompt, paired with one visual stimulus within a visual field of two. IPL reduces perceptual and attention demands during tasks of comprehension, by utilizing a longer eye gaze towards specified stimuli as a measurement. IPL was chosen as an alternative approach in measuring comprehension of novelty words. Results from Syrnyk and Meints' study (2017) demonstrated that infants, at the young age of nine months, display comprehension for words that their parents reported them understanding. Measuring IPL in infants additionally indicated the development of correct word-referent mapping at 9 months of age (Syrnyk & Meints, 2017).

The receptive language abilities demonstrated in infants as young as nine months old emphasize the importance of caregiver interaction during language development (Syrynk & Meints, 2017). Through daily and natural interactions, caregivers often model different interactive behaviors. Behaviors of turn-taking, imitation, and joint attention help foster communication, increasing overall infant engagement and later abilities to interact with others (Paul & Norbury, 2012).

Erickson, Duvall, MacLean, Tonogan, Ohls, and Lowe (2018) conducted a study examining child-mother interactive behaviors and cognition in preschoolers born pre-term and full term. The *Wechsler Preschool and Primary Scale of Intelligence- Third Edition* (WPPSI-III; Wechsler, 2002) measures cognitive ability and provides Verbal and Performance IQ scores. Erickson et al. (2018) found that when provided child-mother interactive behaviors, children demonstrated similar Verbal and Performance IQ scores, regardless of their birth status (preterm or full term). Through the use of interactive behaviors, verbal stimulation, emotional attunement, and an overall exposure to rich language, caregivers can facilitate cognitive development, even at a young age (Erickson et al., 2018).

Fostered by language exposure and caregiver interactive behaviors, as an infant's receptive language continues to grow, communication slowly becomes more intentional. The infant begins to request and mand, with the emergence of pre-symbolic communication. These include gestures of giving, pointing, and/or nonlinguistic vocalizations (Thal et al., 2013).

Linguistic Development

Gradually, modes of communication begin to vary. Reflexive vocalizations, such as coughing, sneezing, and crying, are supplemented with the gradual acquisition of canonical babbling. Canonical babbling occurs between 6 to 10 months of age and consists of at least one vowel-like element and one consonant-like element within a syllable (i.e. [ba], [baba]) (Oller et al., 1998). The presence of a consonant-like element creates speech-like vocalizations within babbling, acting as an important benchmark in communicative growth and caregiver interaction. In response to the presence of speech-like utterances, caregivers often unintentionally alter their verbal interactions to attribute meaning to their infant's canonical babbling (Oller et al., 1998). Babbling slowly matures from the reduplicated structure of canonical babbling to variegated babbling, with the introduction of successive non-identical syllables (i.e. [bado] [badabee]).

Infants at this time are continuing to explore verbalizations, often mimicking the intonation of conversation surrounding them. This use of adult-like speech patterns is known as "conversational babbling" or "jargon." Jargon, which usually appears around 10 months of age, demonstrates a growth in sequencing sounds and a greater awareness of adult conversation surrounding them (Mize, 2008). Continuous verbal play and exploration continues to facilitate lexical acquisition, which eventually influences first words. First words are often simple in structure and made up of the early consonant sounds acquired through the process of babbling (Majorano, Bastainello, Morelli, Lavelli, & Vihman, 2019).

Language Development (1 to 3 Years of Age)

Language development is not a process acquired in a piecemeal fashion. As the child is moving through phases of reflexive, pre-linguistic development to meaningful speech and word combinations, language is developing across areas of form, content, and use (Majorano et al., 2019). Form is a component of language that includes area of phonology, morphology, and syntax; dealing with structure and meaning of words and sentences. Content of language involves semantics, or meanings of words and sentences. The use of language, also called pragmatics, combines the form and content of language to facilitate functional and socially appropriate communication.

Phonology

Within phonological development, individual speech sounds or "phonemes" are the first elements of language to be learned (Vihman, 2017). In order to demonstrate proper phonological use within language, an infant must learn the overall sound system and different rule governed sound combinations within a specific language. By 12 months of age, most infants have an inventory of native speech sounds. Gradually, their ability to distinguish native phonemes from non-native phonemes also improves (Swingley, 2017). This initial acquisition of language-specific speech sounds is demonstrated by the development of an infant's first words. Combined with the use of babbling and jargon, children are developing an inventory of one-word utterances, often emerging at the first year mark.

For these first few months of verbalizations, word acquisition is slow. Once the child reaches the 16 to 18 month mark, there is a rapid growth in verbal communication in which words are learned at a fast rate (Fenson et al., 1994). As a result, a child's

verbal repertoire gradually becomes more complex, with a noted increase in word length and phonological memory (Majorano et al., 2019). This growth in phonological development can be measured through the progression of babbling to word forms with specific targets (Vihman, 2017).

Throughout this pre-literacy period, children are often exposed to rhymes, poems, songs, and silly sayings. Consistent language integration exposes children to rhyme and syllable awareness, setting them up for literacy competency (Perna, Loughan, Northington, & Perkey, 2015). The acquisition of phonological skills is not only crucial to the developmental process of language, but reading acquisition as well (Swingley, 2017). The ability to produce, interpret, and manipulate language-specific speech sounds is the core basis for the learning of words and morphology.

Semantics

Fostered by gradual phonological development and acquisition of consonant vowel combinations, intelligible one-word utterances emerge. First words typically include vocabulary of what is familiar to the child, such as family members, favorite toys, or foods. As vocabulary is limited at this age, a child typically holds multiple meanings to compensate for a limited vocabulary (Vihman, 2017). With a smaller expressive lexicon, overextensions and under extensions occur as common errors in meaning. For example, "cookie" stands as a referent for all sweet desserts until the child experiences further exposure and learning of all other sweet desserts relevant to their environment (Perna et al., 2015).

A child's expressive vocabulary increases considerably after the establishment of the initial first words. By 18 months of age, at least 50 words should be present in a

child's expressive language inventory (Paul & Norbury, 2012). With their expressive lexicon expanding, errors of meaning in turn decrease. As two-word combinations begin to emerge, consistent word order is utilized in order to demonstrate relation. Semantic use begins to extend single word meanings, i.e. combining words to signify a meaning of possession "doggy" and "bed" to "doggy bed." Semantic relations tend to develop in children between 18 to 36 months of age (Paul & Norbury, 2012).

Syntax

The rapid growth in vocabulary is paired with the onset of two-word utterances (DeVeney, Hagaman, & Bjornsen, 2017). Two to three word combinations begin to appear around 18 to 24 months (Paul & Norbury, 2012). Initially, word combinations are "telegraphic," consisting of short words devoid of grammatical markers (i.e. "me cookie") (Perna et al., 2015). This transition from single words to multi-word utterances is significant as sentence structures at this stage of language acquisition simultaneously demonstrate growth in semantic relations. Essentially the child is combining words, resulting in new meanings. Multiword utterances can include structures of action and object (push truck), demonstrative and entity (this car) and negation (no sleep) (Brown, 1973). With continued language exposure, inflectional markings and grammatical function words (i.e. articles "a", "the") begin to shape a child's utterances into patterns more reminiscent of adult speech (Fenson et al., 1994). By the age of 3, children should demonstrate a mean length of utterance of 3 words or more (Brown, 1973).

Morphology

Grammatical development begins between 24 and 30 month of age and is marked by additions of basic inflections and function words within spoken communication

(Fenson et al., 1994). The ability to discriminate, comprehend, and utilize grammar appropriately is a milestone that requires a child to apply their evolving skills of phonetic discrimination while analyzing different structures of speech to develop a natural ability for language marked by proper phonological development, semantic use, and appropriate syntax. According to Brown's stages of development (1973), use of the present progressive "ing," regular plurals "-s," and prepositions of "in" and "on" is expected between 27 to 30 months of age. By 31 to 34 months of age, grammatical structures grow to include irregular past tense, possessive "'s," and uncontractible copulas. Around the age of 3, articles, regular past tense, and third person regular begin to appear within a child's verbal repertoire (Brown, 1973).

Pragmatics

Initially, through pre-linguistic means of communication, infants learn to affect change through gestures, gazes, and vocalizations. Pragmatically, they are establishing the ability to attend, self-regulate, and eventually create mutual engagement through two-way communication (Crais, 2011). Actions of attention seeking, requesting, protesting, commenting, greeting, and answering are achieved through these early communicative intentions (Hulit & Howard, 2002). As the child's first words and word combinations are emerging, they are learning to utilize speech as a means to interact with their environment and affect the behaviors of others, progressing beyond their initial pre-verbal cries, cooing, and laughter (McCormick et al., 2003). At the 12-month mark, proper social interactions, behavior regulation, joint attention, and communicative intent should be demonstrated regularly (Crais, 2011).

A longitudinal study by Wetherby, Cain, Yonclas, and Walker (1988) examined the communicative rate of 15 children in Florida. Each participant's communicative rate was measured through three major categories of behavioral regulation, social interaction, and joint attention, within a 30-minute conversational sample. Data was gathered over the course of a year, with participants within the age range of 11 to 14 months at initial testing. Results demonstrated an increase in the rate of communication as a product of maturation and increased language abilities. Within the pre-linguistic stage, participants demonstrated an average of one act of communication per minute. As the child reached the one-word stage, acts increased two per minute. By the multiword stage, participants communicated with an average of five acts a minute, demonstrating an increased mean length of utterance and overall lexicon use (Wetherby et al., 1988).

Between 1 and 3 years of age, skills essential for social competence are learned and acquired within a play-based context. These pragmatic abilities later attribute to the ability to initiate and sustain appropriate social peer interactions. Beyond the acquisition of certain rules and structures, the use of language gradually transitions into "a vital means of engaging with the social world and organizing one's experiences within it" (Conti-Ramsden & Durkin, 2012, p. 386). Engagement within social settings requires the ability to repair communication breakdowns, appropriately turn take, and sustain discourse. An inability to comprehend these subtle pragmatic changes can result in negative peer rejection, affecting behaviors and education overall (Craig-Unkefer & Kaiser, 2002).

By the age of 3, children should have achieved the basic foundations of language form, content, and use. Aspects of phonology, semantics, syntax, morphology, and

pragmatics should be established at an age appropriate level, as to continue fostering language learning and supporting overall communication. A lack of mastery within these domains of language may indicate a possible delay or disorder in language. Without a solid foundation of speech and language, communication breakdowns affect caregiver and peer interactions negatively (Craig-Unkefer & Kaiser, 2002).

Common Language Delays and Disorders

Delay Versus Disorder

An important distinction between a language delay and disorder is the language acquisition of the child. Individuals who present with a language delay often have a general immaturity in the acquisition of language, functioning at the level appropriate of a younger, typically developing child (Prasad, 2015). This "immature" language acquisition demonstrates the same growth trajectories as normally developing children, just markedly slower in the rate of growth. Across both typically developing and language impaired children, the language growth trajectory generally begins with the early comprehension of spoken language. Initially comprehension is demonstrated at word level, eventually leading to combinations of spoken words into simpler sentences (Billeuad, 2003).

In order to be classified as a language delay, a global delay in language is not necessary. Children may present with age appropriate dimensions of language, such as vocabulary development or semantics, but inversely display delays within the areas of syntax, morphology, etc. Some children demonstrate an initial "late start" in language acquisition that does not warrant a diagnosis of a "disorder", as these children will later

catch up to an age appropriate level. Instead, professionals opt to refer to such cases a language "delay" (Paul & Norbury, 2012).

In contrast to the slow and gradual language acquisition of a language delay, the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; APA, 2013) defines a language disorder as "persistent difficulties in the acquisition and use of language across modalities ... " (p. 41). While a language delay demonstrates a slower growth trajectory in language development, a disorder "suggests a significant deviation from the typical developmental trajectory" (Paul & Norbury, 2012, p. 4). Individuals diagnosed with a language disorder demonstrate language abilities that are significantly below their peers. This substantial difference in acquisition and use of language often results in disturbances within overall communication, professional and education achievement, and social interactions (American Psychiatric Association [APA], 2013).

Difficulties in language acquisition and use are tied to inadequate comprehension and/or production of language across an individual's vocabulary, sentence structure, and discourse (APA, 2013). By ages 3 and 4, instead of relying on 200+ words and short phrases to communicate, a child may display limited vocabulary and inability to communicate wants and needs through the use of short phrases (Reed, 2009). A child's comprehension and production of language can be separated into two domains of language, often referred to as receptive and expressive language ability. Receptive language relies on the individual's ability to properly comprehend the different messages received through communication and interactions with others (National Institute on Deafness and Other Communication Disorders, 2010). Expressive language is expressed as the ability to verbally utilize speech and/or visual modalities such as print or sign to

communicate different messages (Mulrine & Kollia, 2015). As difficulties in receptive and expressive language abilities are expressed as general language abilities, these differ in severity depending on the individual (APA, 2013).

Early Symptoms

The first 3 years of language development in a child's life are crucial for their overall communicative development (Billeuad, 2003). A lack of speech, the presence of unclear speech, or atypical speech and language patterns are causes for concern within this age range as early vocalizations act as precursor to a child's linguistic capacity (Mulrine & Kollia, 2015; Oller et al., 1998).

Bavin and Bretherton (2013) conducted a longitudinal study examining language growth and literacy problems over the span of infants' first 7 years of life. Language and literacy abilities were measured through questionnaires, parent-report checklists, and standardized assessments. Within their study, a number of toddlers began to demonstrate early symptoms of a language delay and/or disorder. These participants were later diagnosed as late talkers or primary language disorders. The study found risk factors, related to the diagnosis of a late talker, included a family history of language problems, minority status, and low maternal education.

Late Talkers

It is estimated that late talkers make up 10-15% of 2 year olds (DeVeney et al., 2017). The lack of multiword utterances and restricted expressive language are often criteria used to classify a child as a late talker (Bavin & Bretherton, 2013; Weismer, Murray-Branch, & Miller, 1993). Classification often occurs at the age of 2, as emerging word combinations and an overall increase in expressive language is expected among

typically developing children (Bavin & Bretherton, 2013). The diagnosis of a late talker does not necessarily warrant a later diagnosis of a language disorder; however, it is considered a risk factor, as late talkers do demonstrate poorer language outcomes throughout childhood (Bavin & Bretherton, 2013; Horvath, Rescorla, & Arunachalam, 2019).

Between the ages of 0 and 3, children demonstrate unique amounts of language growth. This heterogeneous nature of late talkers makes it difficult to categorize "late talkers" as accurately and as efficiently as possible (Bavin & Bretherton, 2013). Different "causes" of a late talker can range from a specific underlying language problem to other developmental conditions affecting speech and language.

Primary Language Disorders

Children presenting with speech and language difficulties, unrelated to other developmental skills or biological causes, fit within the diagnosis of a primary language disorder. Deficits in language must be the salient concern, without the presence of a hearing, neurological, or intellectual impairments. Recent research has found that individuals with primary language disorder often exhibit impacted nonverbal cognitive abilities (Bavin & Bretherton, 2013; Yang & Gray, 2017).

Secondary Language Disorders

When delays or differences in patterns of language acquisition indicate a number of primary problems that precede language differences, the diagnosis of secondary language disorder is appropriate. A diagnosis of a secondary language disorder is significantly different from a primary language disorder; as such language difficulties

occur secondary to hearing impairments, general learning disabilities, and or autism spectrum disorder (Paul & Norbury, 2012).

Assessment

Importance of Early Identification

Toddlerhood is a crucial time for learning, with rapid changes occurring in a child's cognitive, social, and language functioning (Kwon, Bingham, Lewsader, Jeon, & Elicker, 2013). An initial delay in expressive language can further impact a child's basic and higher order language skills, including vocabulary, grammar, verbal memory, figurative language, and reading comprehension (Paul & Roth, 2011).

Hammer, Morgan, Farkas, Hillemeier, Bitetti, and Maczuga (2017) conducted a longitudinal study examining the correlation between the late talker population and school readiness. A total of 3,000 analyses of participants were completed by the final data collection. All participants met the criteria for a late talker diagnosis, with expressive vocabulary scores within the lowest 10% as determined by the *MacArthur Communicative Development Inventory* (M-CDI; Fenson, Marchman, Thal, Dale, Reznick, & Bates, 2007).

Cognitive and behavior functioning was assessed and rated at 9, 24, 48, and 60 months of age. School readiness was determined by the participant's math and reading performance. The longitudinal study revealed a risk for reduced school readiness, as late talkers are three times more likely to have low vocabulary scores by 48 months. The odds of low math scores and behavioral problems also increased significantly, with the late talker participants in the study (Hammer et al., 2017).

Overall, the general concern is that for children at such a young age, language delays can affect abilities at a social and personal level, leading to disadvantages in educational performance and pragmatic development (Conti-Ramsden & Durkin, 2012). Early identification is crucial to eliminate such risks and deficits that communication difficulties during the toddler years can create.

Early professional intervention and guidance can greatly benefit children at this age who are experiencing such communicative difficulties. The early professional services implemented for families with children between the ages of 0 to 3 years of age have been coined as "early intervention." This term refers to a multitude of services, "including assistive technologies, speech and language, occupational, or physical therapy; nursing or other medical services; and resources for the parents to better understand and promote their child's development" (Ullrich, Cole, Gebhard, & Schmit, 2017, p. 1).

A literature review by DeVeney et al. (2017) described the general features of current research on parent-implemented and clinician-directed interventions for late talking toddlers. A total of eight studies were described, examining the participants, intervention components, and research quality of each study. All eight studies conclusively reported that both types of intervention correlated with improvements in the child's language and communication skills, regardless of who administered the intervention. These findings support the claim that implementation of early intervention help set the stage for a child's linguistic and communicative development (DeVeney et al., 2017).

Federal Requirements

The Individuals with Disabilities Education Act (IDEA) of 2004 is a federal law intended to increase the identification and intervention outreach for children and their families (Paul & Norbury, 2012). As part of the IDEA legislation, early intervention and early childhood special education (ECSE) was instituted in order to enhance the development, reduce educational costs to society, maximize an individual's potential to live independently, and support the capacity of families to meet the special needs of their infants and toddlers with disabilities (IDEA, 2004).

State and local agencies provide voluntary early intervention and ECSE, as each state possesses flexibility in developing a state plan; whether providing services through the public school system or other health and human services agencies. Most states tend to provide early intervention services through other health and human service agencies until the age of 3. After the age of 3, ECSE is typically provided within the public school system. Other states may designate certain educational agencies as responsible for early intervention and ECSE services, beginning at birth (National Infant & Toddler Child Care Initiative, 2010).

Part C of IDEA details early intervention systems for infants and toddlers with disabilities. From birth to age 3, Part C focuses on providing intervention for both the child and caregiver. Regardless of the agency assigned, Part C mandates early intervention services to be provided in the child's "natural environment." An emphasis on the natural environment of the child is in place to help caregivers embed intervention strategies easily into their child's natural routines (National Infant & Toddler Child Care Initiative, 2010).

Interdisciplinary collaboration and family participation within the early intervention team is acknowledged and encouraged. Specific to each child, early intervention teams include professionals from multiple disciplines (medicine, special education, speech-language pathology, occupational therapy, physical therapy, social work, etc.) (National Infant & Toddler Child Care Initiative, 2010). In situations where a delay has been suspected, eligibility is confirmed through a multidisciplinary evaluation, with further assessments to support planning as needed.

In order to meet federal documentation regulations and support the assessment and planning process, an Individualized Family Service Plan (IFSP) is utilized. The IFSP is reviewed at 6 month intervals, with evaluations at least once a year. However, IFSP reviews can occur in shorter intervals, as frequent reviews may be deemed as necessary in order to provide optimum early intervention (Ross & Mazzoco, 2007). As the child reaches the age of 3, the IFSP is replaced with an Individualized Education Program (IEP), which follows their progress and plan until the age of 21 years.

Assessment Types

IDEA (2004) requires a number of measures, informal or formal, to be used in the evaluation and assessment of the child. It is recommended to avoid a reliance on just one assessment to judge a child's communication system (Billeaud, 2003). A professional should exercise clinical judgment and sensitivity to the child and family in choosing assessments that will provide the most representative results. Assessments can include a language screener, criterion-referenced instruments, developmental scales, standardized assessments, and play-based assessments.

Screening. Prior to a speech and language evaluation, screenings are often conducted as a means to identify children who are at risk for developmental language disorder or exhibiting signs of a language delay. If the results of the screener indicate a cause for concern, an in depth evaluation of speech and language abilities is often recommended to further determine whether the child will qualify for services under the IDEA legislation (Ullrich et al., 2017).

Screeners can include a variety of informal assessments. Possible screeners include clinician created checklists, informal observations, or criterion referenced scales. Criterion referenced instruments, or developmental scales, are helpful in examining a child's communicative, social, cognitive, and motor skills as they compare an individual's performance to typically developing skills (Crais, 2011).

The *Ages & Stages Questionnaires, Third Edition* (ASQ-3; Squires, Twombly, Bricker, & Potter, 2009) is one example of developmental screening tool utilized for children between the ages of 1 month to 5 ½ years. By including developmental domains, other than just communication, the *ASQ-3* distinguishes the child's challenges and strengths in areas of gross motor, fine motor, problem solving, and personal-social. "Profiling play skills with other developmental domains (e.g., communication, social, motor) … can be useful in making diagnostic decisions as well as in intervention planning" (Crais, 2011, p. 352).

However, screeners alone are not always accurate and sensitive to all individuals who may be at risk for a language delay or disorder. This type of informal assessment is often times more sensitive to severe problems, and delayed in terms of detecting milder problems present without any obvious comorbid disabilities (McCauley, 2001).

Standardized Assessments. Within the field of speech-language pathology, most clinicians depend on the use of norm-referenced standardized assessments, provided the ease of a standard score to judge performance relative to a specified average range. The appropriateness of a standardized test to determine the presence of a language delay or disorder is "almost universally accepted in the clinical literature" (McCauley, 2001, p. 146). These standardized tests are an alternative assessment measure for the early intervention population; however, as research warns clinicians on relying solely on these types of assessments (Billeuad, 2003; Lobo, Paul, Mackely, Maher, & Galloway, 2014).

Lobo et al. (2014) found standardized measures to be a potential limitation in identifying early developmental delays. The *Bayley Scales of Infant Development, Third Edition* (Bayley-III; Bayley, 2006) was administered to 54 infants, revealing results of highly unstable delay classifications, low sensitivities, and poor positive predictive values across time (Lobo et al., 2014). Billeuad (2003) also notes the flaws within standardized assessments for the early intervention population, stating, "careful consideration should be given to the norming population on which standardized scores are based" (p. 158).

Play-Based Assessments. Play-based assessments are typically recommended after the initial screenings and evaluations of an infant or toddler (Paul & Norbury, 2012). They allow the clinician to measure skill performance within controlled environments that are natural and child-driven. Interactive play contexts allow clinicians to alternatively focus on sampling the frequency, type, and variety of communicative intent through pre-linguistic gestures, vocalizations, and eye gaze, instead of the prompt driven verbal responses typically found in standardized assessments. This allows for portrayal of a

child's overall pre-linguistic or verbal communicative abilities, helping to accurately determine prognosis for intervention planning (Crais, 2011).

Kwon et al. (2013) examined the influence of social context (parent gender and activity setting) on parenting quality, toddlers' engagement and play behaviors, and parent-toddler language use. Their study determined that parent gender (mother versus father) had no effect on parenting quality and toddlers' engagement and play behaviors. Instead, their study determined that the activity setting (structured task versus free play) constituted differing child and parent interactions, play, and language use. On both sides of engagement, both the child and parents demonstrated more focused and complex play during free play. When compared to the structured task setting, free play involved higher levels of cognitive scaffolding, less negativity, and models of complex language from the parents (Kwon et al., 2013).

Support for play-based assessments is generally consistent within the speech language pathology community, but overall it is recommended that multiple informal and formal assessments be utilized in identifying any delays that an infant or toddler may have (IDEA, 2004). Within a comprehensive speech and language evaluation, there are additional factors that may impact the child's communication skills. These include the child's developmental history and family background; environmental stressors impacting the family and child; language history and proficiency of the child and family; and the family's concerns, priorities, and resources (Crais, 2011). Unlike screeners, standardized tests, or play-based assessments, the factors listed cannot be quantified and compared to the norms of typically developing peers. Instead, the interdisciplinary team conducting

the child's evaluation and assessment must take such factors into professional consideration.

Reliability and Validity of Early Language Assessments

Across all measures of speech and language abilities, measurement quality is expressed through variables of reliability and variability. Validity examines the extent to which a test measures what it claims to, while reliability evaluates stability of a measure across varying conditions (Hutchinson, 1996). Essentially through measures of reliability and validity, a clinician is able to properly address the fundamental adequacy and basis of each assessment. As these measures remain applicable across all measures, reliability and validity provide standard, valuable across the wide breadth of assessments available (McCauley, 2001).

The relationship between reliability and validity is not one of complete reciprocity, as reliability does not guarantee validity. Reliability is considered a contributing factor, instead of a sole determinant of validity (McCauley, 2001). Providing valuable insight within the quality of a measure, reliability demonstrates the consistency of results, relative to the child, across carrying examiners and or administrations (Hutchinson, 1996).

Factors Affecting Reliability

Early speech and language abilities are typically assessed through a diverse battery of assessments, which may include language screeners, criterion-referenced instruments, developmental scales, standardized assessments, and play-based assessments. These measures utilize varying modalities to complete a speech and language profile specific to each child. Methods of data collection include parent report,

elicited performance from the child, or clinician observation. As the measurement quality of reliability is solely dependent on stable results across varying examiners and test administrations, the reliance that early language evaluations place on parent report, client performance, or clinical observation has the potential to negatively impact a test's reliability. Any variables that may affect the child's linguistic performance during an evaluation, will concurrently affect the reliability. Variables such as the setting, appropriateness of materials, cultural factors, and motivation of the child are just a few factors that may misrepresent a child's true speech and language capabilities (Dockrell, 2001). Messick (1983) termed these factors the "social surround," highlighting the examiner, other children, and social expectancies as factors that may affect a child's functioning throughout an evaluation.

Speech and language assessments will always remain limited in the scope of test items, as no test can perfectly measure a child's overall abilities (Dockrell, 2001). Quality measures of validity and reliability provide a clinician insight in possible test use and administration through quantitative measurements. Regardless as to how accurate an assessment can truly be, one must remember that assessments provide static information on a child. Regular monitoring through valid and reliable assessments is recommended, as single developmental measures will always remain limited in the ability to predict later performance (Dockrell & Marshall, 2014).

Importance of Reliability

Adequate and proven reliability within an assessment imply stable measures of speech and language abilities, across different examiners, environments, and clients. Within the field of speech-language pathology, assessments are administered for the

purpose of gathering information specific to an individual's varying strengths and weaknesses. Without stable and reliable testing measures set in place, a breakdown in the identification and proper treatment of individuals within the field of speech-language pathology is to follow (Dockrell & Marshall, 2014).

Gilkerson, Richards, Greenwood, and Montgomery (2017) conducted a study regarding the development and validation of a 52-item parent questionnaire, *Developmental Snapshot.* Focusing on child language and vocal communication development, *Developmental Snapshot* was administered monthly as an aid for parents to increase recognition of milestones and increase professional intervention. Supported by adequate measures of criterion validity and test-retest reliability, the authors found *Developmental Snapshot* to present as an adequate screener for language delays, within the context of pediatric check-in visits or preschools, flagging individuals who may benefit from early intervention (Gilkerson et al., 2017). Through the process of development and validation of any test given test, professionals are able to determine the most appropriate assessment measures for their needs with quantifiable measures of validity and reliability. Psychometric measures of reliability and validity allow professionals to prove such measures as stable and accurate means in measuring a child's current abilities.

Between the ages of 1 and 3, many co-existing factors have the potential to affect a child's early language development. These include, but are not limited to developmental history, family background, and or environmental stressors (Crais, 2011). Through criteria set by either state or local agencies, a thorough evaluation of speech and language abilities must be conducted for individuals who may require services, in order

to provide early intervention services on an as need basis (National Infant & Toddler Child Care Initiative, 2010). With the availability of assessment measures geared towards the early intervention population, professional should take into consideration factors of reliability and stability, as to provide the most accurate measurements.

Rationale/Purpose

Discussions in the literature have been aimed at gaining a better understanding of early language development and classification of delays or disorders within this age range. Within the field of speech-language pathology, evaluations are utilized in identifying and classifying those individuals in need. A wide breadth of assessments is readily available for professionals to utilize in the screening, classification, and goal setting process. However, there is a lack of literature and research focused on the most reliable and accurate measure for the early intervention population. As children between the ages of 1 and 3 often present with decreased regulation of temperament and attachment to certain individuals, a child's performance during an evaluation may be an inaccurate representation of their speech and language abilities. Within this age range, caution is recommended specific to administering an appropriate test and interpretation. The purpose of this study was to investigate early language assessments and reliability across specified assessments in an effort to formulate a more efficient means of assessing speech and language abilities within the early intervention population. Intervention provided at an early age has shown effectiveness and positive results. An emphasis is placed on the importance of screening and identification of language delays and disorders within the 0 to 3 years of age population. Within this population, speech and language

skills are constantly molding and adapting according to a child's needs and environmental demands.

Proper development of speech and language skills has been correlated with positive educational outcomes and overall social and communication success. Ascertaining reliable assessments can only improve a clinician's ability to identify and accurately set treatment plans for those in need of services. However, stable and accurate evaluation tools can only supplement an evaluation so far, as uncontrollable factors such as child temperament, testing environment, methods of data collection, and test stimuli may inadvertently affect a test's reliability and stability. Often times, clinicians are left with the hard decision of choosing between a variety of different assessments, including language screeners, criterion-referenced instruments, developmental scales, standardized assessments, and play-based assessments. The purpose of this study is to identify which tests present as most reliable in administration and results within the population of children between 0 to 3 years of age. Based on previous research, it is hypothesized that play-based assessments would have the highest reliability in comparison to other types of assessments. This prediction is based of the recommendation that children between the ages of 0 and 3, often respond better to play-based settings. Establishing comfortable rapport with a child is of upmost important when gauging speech and language abilities. At times, a clinician's method of approach and child's specific temperament may not be the most conducive in eliciting speech and language, misrepresenting a child's specific abilities. When considering the different methods of assessment, no specific evaluation or assessment type has been found or proven to be perfect for examining speech and

language abilities. The following experimental questions were addressed in the current study:

1) What is the relationship between the scores that are obtained on various measures of early language?
2) Will children be differentially identified depending upon the assessment that is administered?
3) Can briefer screening tools be used to accurately predict results from a comprehensive evaluation tool?

Chapter III

METHODS

Participants

This study was approved by Valdosta State University Institutional Review Board prior to recruitment of participants (see Appendix A). The sample included 12 participants, including 7 males and 5 females. The participants' ages ranged from 7 months of age to 2 years and 10 months of age (mean age = 1 year and 10 months of age). All participants were native English speakers, allowing for this study to assume that participants began their first language acquisition at the same cognitive and physical developmental levels, exposed to similar monolingual home settings.

Participants varied in the levels of expressive and receptive language. Participants were either potential Valdosta State University Speech and Hearing Clinic clients or were recruited specifically for this study. Flyers were posted around and given to parents at Valdosta State University's Speech and Hearing Clinic in Valdosta, Georgia.

The inclusion criteria for participants was the age range at least 2 months of age to no older than 3 years of age. Majority of participants were raised as monolingual, raised in a monolingual environment and family. This allows for the study to assume that these children began their first language acquisition at the same cognitive and physical developmental level, exposed to similar monolingual home settings. As it is difficult to assume that a child has been raised without any exposure to additional languages, it was

inferred that the participants considered monolingual have had much less exposure to a second language in comparison to bilingual individuals.

Measures

Ages & Stages Questionnaires, Third Edition (ASQ-3)

The *ASQ-3* (Squires et al., 2009) is a developmental screening tool designed to screen and identify possible developmental delays in children from1 month of age to 5 ½ years of age. This single stage screener probes certain developmental skills across the domains of Communication, Gross Motor, Fine Motor, Problem Solving, and Personal-Social. These skills are rated according to a descriptive rating scale of "Yes," "Sometimes," "Not Yet."

Converted into a numerical value, as specified by the *ASQ-3*, the descriptive ratings are calculated into Total Area Scores unique to each developmental domain and compared to empirically derived cut off scores. These cut off scores are utilized to indicate whether the participant's performance within a specific developmental domain is considered "above," "close to," or "below" cut off. These descriptive terms are utilized to provide professionals and caregivers with interpretations and recommendations of "appropriate development, continue periodic screenings," "close attention may be warranted with continued regular screenings," or "recommended further diagnostic services with a professional" (Squires et al., 2009).

Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction

The *Rossetti* (Rossetti, 2006) is a criterion-referenced scale, which assesses the preverbal and verbal aspects of communication and interaction of a child. No standard scores, age-equivalents, or percentile rank scores were provided. The *Rossetti* consists of

six subtests, representing crucial developmental domains of a child: Interaction Attachment, Pragmatics, Gesture, Play, Language Comprehension, and Language Expression. Within each developmental domain, behaviors are separated into 3-month intervals, beginning at birth to 3 years of age.

Test items are marked "pass" if a certain behavior denoted in the Record Form is observed, elicited, or reported by the caregiver. As the *Rossetti* was conducted in real-time, behaviors that were not observed or elicited were later inquired within a follow up discussion with the caregiver(s). In order for a participant to meet "mastery" for a certain age range within a developmental domain, all behaviors within the age range were to be observed, elicited, or reported. Results were reported as the highest 3-month interval the client demonstrated mastery in, specific to each developmental domain within the *Rossetti.*

Preschool Language Scales, Fifth Edition (PLS-5)

The *PLS-5* (Zimmerman, Steiner, & Pond, 2011) identifies receptive and expressive language abilities in across standardized scales of Auditory Comprehension (AC) and Expressive Communication (EC). The primary purpose of the *PLS-5* is to identify children who have a language delay or disorder. Across each scale, raw scores were obtained and converted to a standard score and percentile rank. A Total Language Score can also be calculated utilizing the norm-referenced scores from the AC and EC scales. All standard scores resulting from the *PLS-5* administration were based on a mean of 100 with a standard deviation of 15, resulting in an average range of 85 to 115.

Receptive-Expressive Emergent Language Test, Third Edition (REEL-3)

The *REEL-3* (Bzoch, League, & Brown, 2003) is a checklist of language milestones, completed by caregivers, that measures development in both expressive and receptive language. Results are expressed across two core subtests, Receptive Language and Expressive Language, with norm-referenced standard scores and percentile ranks provided.

Specific to the *REEL-3,* subtest standard scores are referred to as Ability Scores and are combined to provide a composite Language Ability Score. *REEL-3* Record Form also interprets the subtest Ability Scores and Language Ability Score into descriptive terms of Very Superior, Superior, Above Average, Average, Below Average, Poor, and Very Poor. The Ability Scores were based on a mean of 100 and a standard deviation of 15. The descriptive term of "Average" is specific to ability scores ranging from 90 to 110.

Procedures

Parents or guardians of the potential participants were given a consent form (see Appendix B) to complete prior to each child's evaluation. The evaluations only occurred after parents signed the consent form. The evaluations took place on-site at the Valdosta State University Speech and Hearing Clinic. The parents or guardians of the participant were able to choose whether to accompany the client for the evaluation or elect to wait in the waiting room.

Prior to the scheduled evaluation date, parents or caregivers were provided the *REEL-3* and *ASQ-3* via email or in person to complete, as these were questionnaires to be filled out by caregivers of the participants. The *REEL-3* and *ASQ-3* were provided ahead

of time to allow for real-time assessment to be completed over one evaluation session versus multiple. Data from *Rossetti* and *PLS-5* were collected in real-time on the corresponding record forms for each test. Within a play-based environment, the clinician utilized prior parent report and real time observations to complete the *Rossetti.*

The *PLS-5* was completed utilizing prior parent report, real time observations, elicited participant actions and verbalizations with the provided stimulus easel and manipulatives. As the record form follows specific tasks to measure expressive and receptive language abilities, test administration was conducted in a play-based, clinician-directed environment. The participants completed the necessary components for the *Rossetti* and *PLS-5* independently in one sitting with breaks provided as necessary. Scoring of each test was completed by the primary research after administration of testing took place.

For two participants, past history was significant for a prior comprehensive speech and language evaluation, with similar test batteries. Provided consent from the participant's parent and/or guardian, speech and language reports were obtained and verified that a certified CCC-SLP had conducted the evaluation. As minimal amount of time had passed since the last evaluation (less than 30 days), any overlapping assessments of past evaluations and this current study were included as part of the analysis. Assessments that were not conducted as part of the participant's past evaluations were administered in a one-time session with the primary researcher.

Following each evaluation, parents received an informal expressive and receptive language evaluation report explaining how each child performed on the administered assessments, with recommendations and referrals included as necessary. Parents were

encouraged to contact the researcher with any comments, concerns, or questions regarding the information included within each report.

Four measures of expressive and receptive language abilities were administered during each evaluation in attempt to answer the following research questions: 1) What is the relationship between the scores that are obtained on various measures of early language? 2) Will children be differentially identified depending upon the assessment that is administered? 3) Can briefer screening tools be used to accurately predict results from a comprehensive evaluation tool?

Administration of test order was counterbalanced to reduce the likelihood of fatigue systematically affecting the results. The following tests were administered: *Ages & Stages Questionnaires, Third Edition* (ASQ-3; Squires et al., 2009), *Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction (*Rossetti, 2006), *Preschool Language Scales, Fifth Edition* (PLS-5; Zimmerman et al., 2011), and *Receptive-Expressive Emergent Language Test, Third Edition* (REEL-3; Bzoch et al., 2003). These four assessments allowed for analysis of language screeners, criterion-referenced instruments, developmental scales, standardized assessments, and play-based assessments as it relates to the reliability of different early intervention assessment tools. Each assessment administered is listed in Table 1 provided below.

Table 1. *Assessment Tools Administered*

Assessment Tool	Description
Ages & Stages Questionnaires, Third Edition (ASQ-3)	Parent-completed questionnaire Descriptive category scores provided
The Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction	Criterion-referenced scale completed either from direct observation or caregiver report Age-equivalent scores provided
Preschool Language Scales, Fifth Edition (PLS-5)	Norm-referenced assessment Age-equivalent, percentile rank, and standard scores provided
Receptive-Expressive Emergent Language Test, Third Edition (REEL-3)	Caregiver interview checklist Age-equivalent, percentile rank, ability scores, and descriptive category scores provided

Analysis

As previously mentioned, the following tests were administered and scored: *ASQ-3, Rossetti, PLS-5,* and *REEL-3*. Once the standardized scores from all four tests were recorded, the distributions of the scores on each test were analyzed for skewness and outliers. To answer the experimental question regarding the relationship between the scores that were obtained on the *PLS-5*, *REEL*, and *ASQ-3*, a Pearson Product-Moment correlations analysis was conducted.

In addition, in order to answer the experimental question regarding the prediction of comprehensive evaluation results, a step-wise linear regression analysis was used. In the analysis, a step-wise linear regression model was utilized on the *PLS-5 Total Language* scores with all available scores serving as potential predictors (*PLS-Auditory, PLS-Expressive, REEL-Receptive, REEL-Expressive, REEL-Total, ASQ-Communication, ASQ-Gross Motor, ASQ- Fine Motor, ASQ-Problem Solving, and ASQ-Personal Social*).

In the subsequent analysis, all scores that were obtained on the *PLS-5* were excluded from the step-wise regression analysis, which was repeated.

Finally, in order to investigate the experimental question, which addressed the consistency in identification between the various tools, a simple descriptive analysis was conducted. An agreement table was produced which demonstrated the agreement between each assessment tool in regards to the number of participants, which would have been identified as exhibiting atypical language patterns. In addition, agreement was analyzed on the individual level. The number of participants whose results would have lead to the same diagnostic term being applied 100% (four out of four tests in agreement), 75% (three out of four tests in agreement), and 50% (two out of four tests in agreement) were identified. Of pressing concern to the current study is the consistency by which the *ASQ-3* subtest that is specifically devoted to communication would demonstrate compared to the other, more comprehensive language measures. This test is frequently administered in pediatric doctor's offices, which serve as a common gateway for most children. As such, it was of interest to calculate the specificity and sensitivity of this measure as it pertains to the comprehensive evaluation results obtained from the *PLS-5*.

Chapter IV

RESULTS

In order to address the objective of determining the reliability of early language assessment tools, the previously mentioned assessments were administered to 12 participants. Individual participant data and assessment results are provided in Appendix C. Assessment results include standard scores, descriptive ratings, and the determined mastery of developmental domain specific to each test's provided format of results. Mean results from the *PLS*-5, *REEL*-3, and *ASQ*-3 can be observed in Table 2. As the *Rossetti* is a criterion-reference scale, it provides an Age Performance Profile, in which the highest 3-month interval of mastery is reported. As a result, no mean standard or scaled scores could be pulled from *Rossetti*'s qualitative data.

Correlations

The first experimental question addressed the relationship between the scores that were obtained on the *PLS-5*, *REEL-3*, and *ASQ*-3. The results of the correlation analysis are presented in Table 3. The language assessment scores that were obtained on the *PLS-5* composite language score significantly correlated with the subtest scores that were also obtained on the *PLS-5*. In addition, the *PLS-5* composite language scores were significantly correlated with the *REEL-Expressive* and *REEL-Total* scores. Finally, the *PLS-5 Total* score was significantly correlated with the *Problem Solving* subtest of the *ASQ-3*. The highest correlation values were obtained from the *PLS-5* itself. In order, the strongest relationships as revealed by the correlation coefficients were *PLS-Auditory*, *PLS-Expressive*, *REEL-Expressive*, *REEL-Total*, and *ASQ Problem Solving*. The

correlation values between these scores ranged from .79 to .99 indicating high degrees of correlation.

Table 2. *Descriptive Statistics: Mean Standard and Scaled Scores*

Subtest	Mean Score (SD)	Minimum	Maximum
PLS AUD+	98.66 (28.63)	50	150
PLS EXP+	95.67 (29.64)	50	150
PLS TOTAL+	97.33 (29.38)	50	150
REEL REC+	97.08 (14.99)	70	118
REEL EXP+	91.42 (16.94)	56	110
REEL TOTAL+	93.17 (16.93)	56	111
ASQ COMM	42.08 (16.13)	5	60
ASQ GROSS	47.92 (11.27)	30	60
ASQ FINE	32.50 (17.85)	0	60
ASQ PROB SOLV	39.17 (12.22)	15	55
ASQ PERSONAL SOCIAL	38.33 (12.13)	15	55

Note. + denotes standard score, average = 100, standard deviation = 15

Table 3. *Correlations Among Predictors*

	1	2	3	4	5	6	7	8	9	10	11
PLS AUD	-										
PLS EXP	.967**	-									
PLS TOTAL	.991**	.991**	-								
REEL REC	.520	.494	.514	-							
REEL EXP	.914**	.922*	.928**	.569	-						
REEL TOTAL	.830**	.822**	.836**	.864**	.906**	-					
ASQ COMM	.559	.574	.590	.168	.644*	.487	-				
ASQ GROSS	.383	.352	.365	.063	.327	.232	.387	-			
ASQ FINE	.368	.421	.397	.358	.373	.417	.017	-.455	-		
ASQ PROB SOLV	.754**	.819**	.793**	.617*	.895**	.866**	.500	.037	.605*	-	
ASQ PERSONAL SOCIAL	.531	.608*	.587	.371	.688*	.616*	.630*	-.205	.666*	.805**	-

Regression Analyses

The second experimental question addressed whether or not *PLS-5* scores could be significantly predicted using any of the briefer measures that were utilized (*REEL-3, ASQ*-3) or even a single subtest of the *PLS-5* (*Auditory Comprehension* or *Expressive*

Language). When using all available subtest scores (including the *PLS-5* scores), the stepwise linear regression model entered both the *PLS-5* subtest scores, $F\,(2, 9) = 3206.28$, $p < .001$, $R^2 = .99$, $R^2_{Adjusted} = .99$. When removing *PLS-5* values from the equation, *REEL-Expressive* scores were the only scores that were entered into the stepwise procedure, $F\,(1, 10) = 51.91$, $p < .001$, $R^2 = .838$, $R^2_{Adjusted} = .822$.

Consistency Among Diagnoses

An agreement table was produced which demonstrated the agreement between each assessment tool in regards to the number of participants, which would have been identified as exhibiting atypical language patterns. It may be viewed in Table 5. In addition, agreement was analyzed on the individual level. The number of participants whose results would have lead to the same diagnostic term being applied was also visualized with a table (see Table 4).

The final analysis was specifically concerned with the specificity and sensitivity of the *ASQ-3* tool due to its high usage rates within pediatric medical facilities. Since sensitivity and specificity are concerned with true positives and true negatives, then a reference must be established. For the sake of the current experiment, the results from the comprehensive *PLS-5* assessment were used as the referent. The *ASQ-3*'s sensitivity (or true positive rate) was determined to be 66.67% indicating that the assessment tool was 67% likely to accurately identify those with a language disorder. The *ASQ-3*'s specificity rate was determined to be 55.57% indicating that the assessment tool was 56% likely to accurately identify those without a language disorder.

Table 4. *Number of Participants Identified with Atypical Language Abilities*

Assessment Tool	**Number of Participants Identified With Atypical Language Abilities**
PLS-5	3 (25%)
REEL-3	5 (42%)
ASQ-3	6 (50%)
Rossetti	5 (42%)

Table 5. *Agreement Among Tests*

Agreement Among Tests	Number of Participants
100% (4/4 agreement)	4
75% (3/4 agreement)	4
50% (2/4 agreement)	3

Chapter V

DISCUSSION

The backbone of the clinical service delivery rests upon the accuracy by which we can identify those who need the services that are being operated. Treatment should most certainly be directed by assessment. Unreliable assessment can lead to establishing goals and treatment hierarchies that are unnecessary, inappropriate, or even wasteful. The statistical analyses that were completed in the current study revealed both promising and alarming matters of interpretation in this regard.

The finding of high associations among the *REEL-3*, a parental questionnaire, and the *PLS-5*, a comprehensive evaluation tool offers the potential for flexibility in the matter of assessment. In-depth, direct evaluation sessions take time to administer and this time requirement is commonly contraindicated for young children. Attention and other behaviors fluctuate much more dramatically across extended time periods for young children, which can drastically affect reliability and validity. The capability to supplement or potentially even replace direct, comprehensive measures with measures that are obtained via parental reports could be extremely advantageous for early interventionists. However, caution should be taken considering that there are certainly elements of parental questionnaires that could also drastically affect the reliability and validity. For example, the reliability of parental report measures has not been assessed as a function of who the informant is. It is possible that mothers, fathers, or other caregivers do not exhibit consistency across their response patterns. This potentially leads to a child being diagnosed as WNL vs. disordered on the same test, depending upon who provided the responses. Future studies should consider this avenue of inquiry.

The alarming portion of the current findings is associated with the inconsistency that existed across the varying measures of early language. Four different measures of receptive and expressive measures were administered to each child participant in the current study. Multiple children would have been diagnosed differentially based upon the results that were obtained. Clinically, this breeds uncertainty regarding whether a child actually requires services. Thinking critically about behavioral test results is absolutely encouraged; however, having little confidence in their results is not necessarily beneficial.

A certain element of uncertainty is inherent in assessment tools, especially screeners. Screeners are by definition intended to be brief while covering a large array of behaviors, which can lead to both over-identification of those who might need services and under-identification of those who might not need services. Psychometricians quantify this uncertainty in terms of sensitivity and specificity. Sensitivity is a numerical value that represents the likelihood of a true negative. In other words, the screening results indicate an area of concern and the comprehensive assessment results confirm this finding. Contrastively, specificity represents the likelihood of a true negative meaning the screening results indicate no presence of a disorder and the comprehensive assessment results confirm. Often, there is a give and take involved in what is essentially a sensitivity-specificity trade-off. Higher levels of specificity often come at the expense of lower levels of sensitivity. The ultimate goal is to have both values within an acceptable range. The common understanding regarding the screening of language is that screeners should err on the side of specificity meaning that there should be greater levels of confidence in a passed screening than there should be in a failed screening. The

outcomes of false negatives are far less severe than the outcomes of a false positive. A failed screening that eventually is revealed as a false negative leads to the administration of a comprehensive test, which will hopefully provide a more valid and reliable depiction of the child's language skills. A passed screening that eventually would be revealed as a false negative often results in no additional assessment which leaves the child receiving none of the beneficial services that they could otherwise be receiving.

The current study revealed extremely low levels of both sensitivity and specificity in regards to communication skills for the *ASQ-3*. The sensitivity and specificity values that were reported by the *ASQ-3* were in deed satisfactory. However, the analyses that lead to these determinations focused more upon global processes instead of communication specific processes. The current study utilized the *PLS-5* as the comprehensive measure by which agreement was gauged whereas the *ASQ-3* utilized the *Battelle Developmental Inventory, 2nd Ed*. (BDI-2) (Newborg, Stock, Wnek, Guibubaldi, & Svinicki, 2004). The *BDI-2*, much like the *ASQ-3*, assesses five different developmental domains. For the developers of the *ASQ-3*, a true negative was considered if the individual passed all domains on the *ASQ-3* and the *BDI-2* whereas a true positive occurred when an individual failed one or more domains on the *ASQ-3* as well as the *BDI-2*. Their analytical methods did not consider how accurately the results from the communication domain, for example, of the *ASQ-3* matched up with the communication domain of the *BDI-2*. The lack of specificity and sensitivity values specifically concerning the communication domain of the *ASQ-3* is alarming. Physicians, among other professions, commonly utilize the *ASQ-3* as part of the routine care of their pediatric clients. If this screening tool reveals no areas of concern, then the pediatrician

is less likely to make an appropriate referral to a speech-language pathologist for additional assessment. The current results indicate that this protocol could severely be under-identifying those who could benefit from speech-language intervention.

Implications

Previous research has supported the use of multiple assessments when conducting evaluations for children between 0 and 3 years of age due to the complexities and challenges that are associated with the assessment of young children. The findings gathered from the current study support that statement. In comparison to the rest of the test battery administered as part of this study, the *PLS-5* was presented as the most "comprehensive" assessment, with all other *ASQ-3*, *REEL*, and *PLS* subtest scores serving as potential predictors. When considering which assessment could be conducted, excluding the *PLS-5* subtests, the *REEL-Expressive* was found to have the highest correlation with the overall *PLS-5* administration. Specific to this current study, it is implied that administering the *REEL-Expressive* subtest can provide an adequate amount of information when compared to the *PLS-5*. As the *REEL-3* is a caregiver interview checklist, these results can provide an alternative to administering the entire *PLS-5*, requiring the child to be actively present and interact with the clinician for an extended amount of time.

Caution should be exercised when showcasing dependence on screening tools however. Although the *ASQ-3* is utilized as a screener throughout a number of pediatric offices, the current results indicate alarmingly low rates of sensitivity (66.67%) and specificity (55.57%) in comparison to the comprehensive *PLS-5*. Within a speech and language evaluation, results cannot be guaranteed to be 100% reliable. No specific

method of assessment has been found or claimed to be errorless when evaluating young children. Simply, at the young ages between 0 to 3 years of age, many variables come into play that clinicians must be able to subjectively analyze to make the best possible judgment. Results from this study coincide with the IDEA's recommendation to avoid a reliance on just a single assessment to determine a child's speech and language abilities. The challenging aspect of this finding is that screeners are supposed to be brief while simultaneously focusing on a wide array of language abilities. It is possible that the *ASQ-3* serves as a valid and reliable instrument for the screening of many developmental processes; however, the current results strongly indicate that it should not serve as a sole measure of communication, even if only used as a screener.

Limitations

The results of this study are limited to the four assessment tools included. The four standardized tests used for this research have not been researched in the same combination in any previous research, so results cannot be considered definitive. Another limitation is the time constraint that was placed on each participant's evaluation session. As to promote participation and increase in willing participants, evaluations were limited to a single 75-minute session. As a result, the *ASQ-3* and *REEL-3* were provided prior the evaluation, lacking in-depth instruction by the researcher. Future studies investigating the reliability between early language assessments are needed to add further diversity of assessments, as many varieties are currently published and utilized by individuals in the field. As this study was limited to one main researcher conducting evaluations within a limited amount of time, it is recommended for future studies to increase the number of participants. This would allow for more concrete

recommendations and well supported conclusions to be made in regards to the reliability of early language assessments, beyond the limited participants and assessments measured within this study.

Conclusions

The assessment of the language capabilities of young children is indeed a challenging endeavor. This endeavor is made all the more challenging by issues that are associated with the psychometric properties of the tests themselves. A lack of agreement between various tests that are in theory designed to assess similar constructs is alarming. In addition, the lack of acceptable sensitivity and specificity values for a well known, highly utilized screening test is alarming as well. Regardless of whether or not screening tests, direct tests, or indirect measures are being utilized, the current study strongly emphasizes the importance of considering multiple measures in the identification of those who are at risk for language-based disorders. Future studies should expand upon the tests, which were used while increasing the participant pool.

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APPENDIX A:

Institutional Review Board Approval

VALDOSTA STATE UNIVERSITY

Institutional Review Board (IRB) for the Protection of Human Research Participants

EXPEDITED PROTOCOL APPROVAL

PROTOCOL NUMBER: IRB-03597-2018

RESPONSIBLE RESEARCHER: Dr. Matthew Carter
CO-INVESTIGATOR: Katherine Moon

PROJECT TITLE: *The Reliability of Early Language Assessment Tools.*

APPROVAL DATE: 03.22.2018 **EXPIRATION DATE:** 03.21.2019

LEVEL OF RISK: ☒ Minimal ☐ More than Minimal

TYPE OF REVIEW: ☒ Expedited Under Category 7 ☐ Convened (Full Board)

CONSENT REQUIREMENTS:

- ☐ Adult Participants – Written informed consent with documentation (signature)
- ☐ Adult Participants – Written informed consent with waiver of documentation (signature)
- ☐ Adult Participants – Verbal informed consent
- ☐ Adult Participants – Waiver of informed consent
- ☒ Minor Participants – Written parent/guardian permission with documentation (signature)
- ☐ Minor Participants – Written parent/guardian permission with waiver of documentation (signature)
- ☐ Minor Participants – Verbal parent/guardian permission
- ☐ Minor Participants – Waiver of parent/guardian permission
- ☐ Minor Participants – Written assent with documentation (signature)
- ☐ Minor Participants – Written assent with waiver of documentation (signature)
- ☐ Minor Participants – Verbal assent
- ☐ Minor Participants – Waiver of assent
- ☐ Waiver of some elements of consent/permission/assent

APPROVAL: This research protocol is **approved** as presented. If applicable, your approved consent form(s), bearing the IRB approval stamp and protocol expiration date, will be mailed to you via campus mail or U.S. Postal Service unless you have made other arrangements with the IRB Administrator. Please use the stamped consent document(s) as your copy master(s). Once you duplicate the consent form(s), you may begin participant recruitment. **Please see Attachment 1 for additional important information for researchers.**

COMMENTS:

Elizabeth Ann Olphie 03.22.2018

Elizabeth Ann Olphie, IRB Administrator Date

Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-259-5045.

Form Revised: 06.02.16

EXPEDITED PROTOCOL APPROVAL REPORT
Attachment 1

ADDITIONAL INFORMATION FOR RESEARCHERS:

If your protocol received expedited approval, it was reviewed by a two-member team, or, in extraordinary circumstances, the Chair or the Vice-Chair of the IRB. Although the expediters may approve protocols, they are required by federal regulation to report expedited approvals at the next IRB meeting. At that time, other IRB members may express any concerns and may occasionally request minor modifications to the protocol. In rare instances, the IRB may request that research activities involving participants be halted until such modifications are implemented. Should this situation arise, you will receive an explanatory communiqué from the IRB.

Protocol approvals are generally valid for one year. In rare instances, when a protocol is determined to place participants at more than minimal risk, the IRB may shorten the approval period so that protocols are reviewed more frequently, allowing the IRB to reassess the potential risks and benefits to participants. The expiration date of your protocol approval is noted on the approval form. You will be contacted no less than one month before this expiration date and will be asked to either submit a final report if the research is concluded or to apply for a continuation of approval. It is your responsibility to submit a continuation request in sufficient time for IRB review before the expiration date. If you do not secure a protocol approval extension prior to the expiration date, you must stop all activities involving participants (including interaction, intervention, data collection, and data analysis) until approval is reinstated.

Please be reminded that you are required to seek approval of the IRB before amending or altering the scope of the project or the research protocol or implementing changes in the approved consent process/forms. You are also required to report to the IRB, through the Office of Sponsored Programs & Research Administration, any unanticipated problems or adverse events which become apparent during the course or as a result of the research and the actions you have taken.

Please refer to the IRB website (http://www.valdosta.edu/ospra/HumanResearchParticipants.shtml) for additional information about Valdosta State University's human protection program and your responsibilities as a researcher.

APPENDIX B:

Institutional Review Board Parent Consent

VALDOSTA STATE UNIVERSITY

Parent/Guardian Permission for Child's/Ward's Participation in Research

You are being asked to allow your child (or ward) to participate in a research project entitled *"The Reliability of Early Language Assessment Tools."* This research project is being conducted by Matt Carter, a faculty member in Communication Sciences and Disorders at Valdosta State University and Katie Moon, a student in Communication Sciences and Disorders at Valdosta State University. The researcher has explained to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks to your child (or ward). You may ask the researcher any questions you have to help you understand this study and your child's (or ward's) possible participation in it. A basic explanation of the research is given below. From this point on in this form, the term "child" is used for either a child or a ward. Please read the remainder of this form carefully and ask the researcher any questions you may have. The University asks that you give your signed permission if you will allow your child to participate in this research project.

Purpose of the Research: This study involves research. The purpose of the study is to measure the consistency between different preschool measures of speech and language abilities. By understanding this relationship, we can better recommend assessment practices for preschool children as part of routine developmental monitoring or when identifying deficits.

Procedures: Your child will spend about 45 minutes with me completing the *Preschool Language Scales – Fifth Edition*. This is a standardized test of speech and language abilities. You and I will spend about 30 minutes together completing a series of checklists and surveys regarding your child's language abilities. Specifically, we will complete the Rossetti Infant Toddler Language Scale- Measure of Communication and Interaction, Receptive-Expressive Emergent Language Test, Third Edition (REEL-3), and Ages & Stages Questionnaires, Third Edition (ASQ-3). In total, you and your child's participation will last approximately 75 minutes. We will determine with you whether or not this time frame needs to be divided into two sessions or one single session. Ultimately, it will be your choice. All direct interaction with your child should occur at the VSU Speech and Hearing Clinic. When you and I are completing test forms, this can occur anywhere within the community. There are no alternatives to the experimental procedures in this study. The only alternative is to choose for your child not to participate at all.

Possible Risks or Discomfort The repeated use of tests and stimulus items between participants can pose as a minor risk of germ contamination between participants during test administration. The surfaces of tests and stimulus items will be disinfected after each session. In addition the participants will be encouraged to wash their hands before and after each session.

With any test administration within this age range (0 to 3 years of age), there is a possibility of a participant becoming frustrated or uncooperative. It is possible that the frustration and separation anxiety may occur. Clinical judgment and parental feedback will be utilized to determine if further testing is possible without incurring emotional harm.

By granting permission for your child to participate in this research project, you are not waiving any rights that you or your child may have against Valdosta State University for injury resulting from negligence of the University or its researchers.

Potential Benefits: The research test administration sessions will be free to all participants. Parents will have access to all of their child's testing results which will provide them with a greater level of understanding regarding

Parent/Guardian's Initials: _____

their child's speech and language abilities. Furthermore, this study allows for the evaluation of the effectiveness between standardized assessment and criterion-referenced scales. Determining the relationship between these variables has major implications for the assessment within the population of children ranging from 0 to 3 years of age.

Costs and Compensation: There are no costs to you or your child and there is no compensation (no money, gifts, or services) for your child's participation in this research project.

Assurance of Confidentiality: Valdosta State University and the researcher will keep your child's information confidential to the extent allowed by law. Members of the Institutional Review Board (IRB), a university committee charged with reviewing research to ensure the rights and welfare of research participants, may be given access to your child's confidential information.

Your child will be assigned a code number as a way to identify and keep track of data. Numbers assigned to your child with not be associated with his/her name or any other identifying information. This is to ensure that individuals remain unidentifiable. Your child's birth date will be recorded as a way to calculate your child's chronological age in order to interpret scores and results of this study. All information obtained from testing will be kept in Dr. Carter's office secured by lock and key. Only those individuals that YOU choose to share the results with will have access to the results.

Data from this study will be reported in combination with testing information obtained from other participants. None of the participants will be identified in this study by name or birth date.

Voluntary Participation: Your decision to allow your child to participate in this research project is entirely voluntary. If you agree now to allow your child to participate and you change your mind later, you are free to withdraw your child from the study at that time. By not allowing your child to participate in this study or by withdrawing him/her from the study before the research is complete, you are not giving up any rights that you or your child have or any services to which you or your child are otherwise entitled to from Valdosta State University. If you decide to withdraw your child from the study after data collection is complete, your child's information will be deleted from the database and will not be included in research results.

Information Contacts:
Questions regarding the purpose or procedures of the research should be directed to Matt Carter at mdcarter@valdosta.edu. This study has been approved by the Valdosta State University Institutional Review Board (IRB) for the Protection of Human Research Participants. The IRB, a university committee established by Federal law, is responsible for protecting the rights and welfare of research participants. If you have concerns or questions about your child's rights as a research participant, you may contact the IRB Administrator at 229-333-7837 or irb@valdosta.edu.

Agreement to Participate: The research project and my child's (or ward's) role in it have been explained to me, and my questions have been answered to my satisfaction. I grant permission for my child to participate in this study. By signing this form, I am indicating that I am either the custodial parent or legal guardian of the child. I have received a copy of this permission form.

I would like to receive a copy of the results of this study: _____ *Yes* _____ *No*

Mailing Address: _____

e-mail Address: _____

This research project has been approved by the Valdosta State University Institutional Review Board for the Protection of Human Research Participants through the date noted below:

_____
Printed Name of Child/Ward

_____
Printed Name of Parent/Guardian

_____
Signature of Parent/Guardian Date

_____
Signature of Person Obtaining Consent Date

APPENDIX C:

Individual Participant Data

Data Sheet

Participant #: 1 DOB: 12/14/15 Age: 2;5 Sex: MALE Date(s): 5/24 – 5/25/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	60	Above
Gross Motor	60	Above
Fine Motor	20	Close
Problem Solving	35	Close
Personal-Social	40	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	24 – 27 months (maximum score)
Play	30 – 33 months
Language Comprehension	27 – 30 months
Language Expression	27 – 30 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	39	127	96
Expressive Communication	34	113	81
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		240	XXXXXX
Total Language Score		122	93

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	62	113	81	Above Average
Expressive Language	60	103	58	Average
Sum of Receptive + Expressive Ability Scores =		216	XXXXXX	XXXXXX
Language Ability Score		110	75	Average

Data Sheet

Participant #: 2 DOB: 11/7/16 Age: 1;7 Sex: FEMALE Date(s): 6/20 – 6/21/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	55	Above
Gross Motor	50	Above
Fine Motor	45	Above
Problem Solving	50	Above
Personal-Social	55	Above

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score
Gesture	24 – 27 months (maximum score)
Play	27 – 30 months
Language Comprehension	18 – 21 months
Language Expression	18 – 21 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	23	96	39
Expressive Communication	25	98	45
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		194	XXXXXX
Total Language Score		97	42

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	46	88	21	Below Average
Expressive Language	50	104	61	Average
Sum of Receptive + Expressive Ability Scores =			XXXXXX	XXXXXX
Language Ability Score		95	37	Average

Data Sheet

Participant #: 3 DOB: 9/9/16 Age: 1;9 Sex: MALE Date(s): 6/22 – 6/25/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	50	Above
Gross Motor	50	Above
Fine Motor	50	Above
Problem Solving	50	Above
Personal-Social	40	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	21 – 24 months
Play	21 – 24 months
Language Comprehension	18 – 21 months
Language Expression	9 – 12 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	24	100	50
Expressive Communication	25	98	45
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		198	XXXXXX
Total Language Score		99	47

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	59	118	89	Above Average
Expressive Language	47	93	32	Average
Sum of Receptive + Expressive Ability Scores =		211	XXXXXX	XXXXXX
Language Ability Score		107	68	Average

Data Sheet

Participant #: 4 DOB: 12/23/15 Age: 2;6 Sex: MALE Date(s): 6/25/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	5	Below
Gross Motor	40	Close
Fine Motor	25	Close
Problem Solving	15	Below
Personal-Social	35	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	3 – 6 months
Pragmatics	6 – 9 months
Gesture	Did not meet criteria at 9 – 12 months
Play	6 – 9 months
Language Comprehension	0 – 3 months
Language Expression	0 – 3 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	8	50	1
Expressive Communication	11	50	1
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		100	XXXXXX
Total Language Score		50	1

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	39	70	2	Poor
Expressive Language	26	<56	<1	Very Poor
Sum of Receptive + Expressive Ability Scores =		126	XXXXXX	XXXXXX
Language Ability Score		56	1	Very Poor

Data Sheet

Participant #: 5 DOB: 11/21/17 Age: 7 months Sex: MALE Date(s): 6/27/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	45	Above
Gross Motor	30	Below
Fine Motor	50	Above
Problem Solving	45	Close
Personal-Social	45	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	6 – 9 months
Pragmatics	6 – 9 months
Gesture	Did not meet criteria at 9 – 12 months
Play	3 – 6 months
Language Comprehension	3 – 6 months
Language Expression	3 – 6 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	14	114	82
Expressive Communication	12	100	50
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		214	XXXXXX
Total Language Score		107	68

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	22	95	37	Average
Expressive Language	20	95	37	Average
Sum of Receptive + Expressive Ability Scores =		190	XXXXXX	XXXXXX
Language Ability Score		94	35	Average

Data Sheet

Participant #: 6 DOB: 11/21/17 Age: 8 months Sex: FEMALE Date(s): 7/19/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	45	Above
Gross Motor	30	Below
Fine Motor	50	Above
Problem Solving	45	Close
Personal-Social	45	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	9 – 12 months
Pragmatics	9 – 12 months
Gesture	Did not meet criteria at 9 – 12 months
Play	6 – 9 months
Language Comprehension	6 – 9 months
Language Expression	6 – 9 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	15	119	90
Expressive Communication	19	132	98
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		251	XXXXXX
Total Language Score		127	96

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	33	110	75	Average
Expressive Language	30	108	70	Average
Sum of Receptive + Expressive Ability Scores =		118	XXXXXX	XXXXXX
Language Ability Score		111	77	Above Average

Data Sheet

Participant #: 7 DOB: 4/22/16 Age: 2;1 Sex: FEMALE Date(s): 5/29; 6/29/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	25	Close
Gross Motor	35	Close
Fine Motor	35	Above
Problem Solving	25	Below
Personal-Social	25	Below

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	15 – 18 months
Gesture	12 – 15 months
Play	21 – 24 months
Language Comprehension	12 – 15 months
Language Expression	6 – 9 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	15	54	1
Expressive Communication	10	50	1
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		104	XXXXXX
Total Language Score		50	1

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	58	105	63	Average
Expressive Language	35	65	1	Very Poor
Sum of Receptive + Expressive Ability Scores =		170	XXXXXX	XXXXXX
Language Ability Score		82	12	Below Average

Data Sheet

Participant #: 8 DOB: 10/18/17 Age: 8 months Sex: MALE Date(s): 7/12/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	50	Above
Gross Motor	60	Above
Fine Motor	60	Above
Problem Solving	55	Above
Personal-Social	50	Above

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	6 – 9 months
Pragmatics	3 – 6 months
Gesture	Did not meet criteria at 9 – 12 months
Play	6 – 9 months
Language Comprehension	3 – 6 months
Language Expression	3 – 6 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	17	150	99
Expressive Communication	20	150	99
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		300	XXXXXX
Total Language Score		150	99

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	30	103	58	Average
Expressive Language	32	110	75	Average
Sum of Receptive + Expressive Ability Scores =		213	XXXXXX	XXXXXX
Language Ability Score		108	70	Average

Data Sheet

Participant #: 9 DOB: 11/22/15 Age: 2;7 Sex: FEMALE Date(s): 7/12/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	45	Above
Gross Motor	60	Above
Fine Motor	0	Below
Problem Solving	30	Close
Personal-Social	15	Below

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	24 – 27 (maximum score)
Play	30 – 33 months
Language Comprehension	27 – 30 months
Language Expression	24 – 27 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	32	93	32
Expressive Communication	29	87	19
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		180	XXXXXX
Total Language Score		89	23

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	54	87	19	Below Average
Expressive Language	54	85	16	Below Average
Sum of Receptive + Expressive Ability Scores =		172	XXXXXX	XXXXXX
Language Ability Score		83	13	Below Average

Data Sheet

Participant #: 10 DOB: 11/22/15 Age: 2;7 Sex: FEMALE Date(s): 7/12/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	45	Above
Gross Motor	60	Above
Fine Motor	10	Below
Problem Solving	30	Close
Personal-Social	25	Below

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	24 – 27 (maximum score)
Play	30 – 33 months
Language Comprehension	27 – 30 months
Language Expression	30 – 33 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	32	93	32
Expressive Communication	32	95	37
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		188	XXXXXX
Total Language Score		93	32

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	54	87	19	Below Average
Expressive Language	54	85	16	Below Average
Sum of Receptive + Expressive Ability Scores =		172	XXXXXX	XXXXXX
Language Ability Score		83	13	Below Average

Data Sheet

Participant #: 11 DOB: 9/3/15 Age: 2;10 Sex: MALE Date(s): 7/10-7/12/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	60	Above
Gross Motor	55	Above
Fine Motor	20	Close
Problem Solving	55	Above
Personal-Social	55	Above

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	24 – 27 (maximum score)
Play	33 – 36 months (maximum score)
Language Comprehension	30 – 33 months
Language Expression	33 – 36 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension	38	109	73
Expressive Communication	36	106	66
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		215	XXXXXX
Total Language Score		108	70

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	66	110	75	Average
Expressive Language	64	105	63	Average
Sum of Receptive + Expressive Ability Scores =		215	XXXXXX	XXXXXX
Language Ability Score		109	73	Average

Data Sheet

Participant #: 12 DOB: 4/1/16 Age: 2;3 Sex: FEMALE Date(s): 7/25; 6/21/18

Assessments

1. **ASQ-3**

	Total Raw Score	Descriptive Term
Communication	20	Below
Gross Motor	45	Above
Fine Motor	25	Close
Problem Solving	35	Close
Personal-Social	30	Close

2. **The Rossetti Infant-Toddler Language Scale**

	Age Performance Profile
Interaction Attachment	15 – 18 months (maximum score)
Pragmatics	18 – 21 months (maximum score)
Gesture	18 – 21 months
Play	24 – 27 months
Language Comprehension	18 – 21 months
Language Expression	18 – 21 months

3. **PLS-5**

	Raw Score	Standard Score	Percentile Rank
Auditory Comprehension (7/25/18)	23	79	8
Expressive Communication (6/21/18)	not available	69	2
Sum of Auditory Comprehension + Expressive Communication Standard Scores =		XXXXXX	XXXXXX
Total Language Score (6/21/18)		76	5

4. **REEL-3**

	Raw Score	Ability Score	Percentile Rank	Descriptive Term
Receptive Language	49	79	8	Poor
Expressive Language	47	88	21	Below Average
Sum of Receptive + Expressive Ability Scores =		167	XXXXXX	XXXXXX
Language Ability Score		80	9	Average